

Curriculum vitæ

Paulo Jorge Lopes de Moura

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1 Personal and Contact Information

Name

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Date of birth

June 16, 1965

Nationality

Portuguese

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Institutional web page

<http://www.di.ubi.pt/~pmoura>

Research web site

<http://logtalk.org/>

2 Education

2.1 Degrees

PhD in Computer Engineering, September 2003, University of Beira Interior. Thesis title: *Logtalk: Design of an Object-Oriented Logic Programming Language* (available at <http://logtalk.org/papers/thesis.pdf>; PDF, 334 pages). Advisor: Abel Gomes. Discussants: Vítor Santos Costa, Mário Martins, Salvador Abreu, and Ana Moreira.

MSc in Systems and Information Technology, December 1995, Computer Engineering Department, University of Coimbra. Thesis title: *Logtalk: Programação Orientada para Objectos em Prolog* (Logtalk: Object-Oriented Programming in Prolog). Advisor: Ernesto Costa. Discussant: Luís Damas.

Undergraduate degree in Computer Engineering, 1989, Computer Engineering Department, University of Coimbra. Undergraduate thesis on explanation-based learning. Third student in class (17.4/20).

2.2 Additional Professional Training

Microsoft Portuguese Academic Days, May 2004.

Constraint Programming, taught by Pedro Barahona (New University of Lisbon), at EPIA'97.

Knowledge Discovery in Databases, taught by Yves Kodratoff (University of Paris-Sud, France), at EPIA'97.

3 Teaching Activity

September 2003 — Now

University of Beira Interior, Department of Computer Science.

Assistant Professor.

Taught Programming Paradigms and Web Information Systems courses to postgraduate students. Taught Imperative Programming, Logic Programming, Object-Oriented Programming, Software Engineering, Multimedia Technologies, Video Streaming and Compression, Web Technologies, and Digital Publishing courses to undergraduate students.

December 2008

New University of Lisbon, Department of Computer Science.

Taught short course on the Logtalk programming language to postgraduate students.

(March 2002 — February 2003

Sabbatical leave to prepare PhD dissertation)

September 1999 — September 2003

University of Beira Interior, Department of Computer Science.

Lecturer.

Taught Imperative Programming, Logic Programming, Object-Oriented Programming, Algorithms and Data Structures, and Software Engineering courses to undergraduate students.

December 1995 — August 1999

University of Coimbra, Department of Mathematics

Lecturer.

Taught Imperative Programming, Algorithms and Data Structures, Linear Algebra, and Geometry courses to undergraduate students.

(September 1990 — November 1991

Mandatory Military Service, Portuguese Air Force)

January 1990 — December 1995

University of Coimbra, Department of Mathematics

Teaching Assistant.

Taught Imperative Programming courses to undergraduate students.

4 Research Activity

4.1 Research Interests

Design and Implementation of Logic Programming Systems. Multi-paradigm Programming Languages. Parallel Logic Programming Systems. Object-Oriented Programming. Aspect-Oriented Programming.

4.2 Research Statement

My research is focused on bringing to Prolog programming powerful encapsulation and code reuse features. Research results are implemented in the (second generation of the) Logtalk programming language, whose development I started in 1998. Logtalk uses compatible Prolog systems as a back-end compiler, providing an extended feature set for programming in the large. Logtalk is developed as a dependable tool, not as a research, discardable prototype. The reward for the required development work is a growing and demanding user community.

Logtalk encapsulation and code reuse features are based on the reinterpretation of object-oriented programming concepts in a logic programming context. To these core concepts, Logtalk adds innovative support for component-based programming, event-driven programming, and, recently, multi-threading programming. This results in a

flexible multi-paradigm, dynamic language for tackling software engineering problems in logic programming development.

Logtalk development faces two major roadblocks: the lack of Prolog standardization and a fragmented community. This prompted me to work closely with Prolog developers on compiler compliance with the ISO standard and with the current standardization proposals. This is a slow, laborious work, where a large amount of time is spent dealing with poorly specified programming constructs and language semantics, buggy compilers, and getting people with different agendas to work together for the common good. Noteworthy contributions to the Prolog community include serving as editor for several ISO Prolog standardization proposals and working closely with the main developers of SWI-Prolog, XSB, and YAP on implementing and specifying the ISO standardization proposal for Prolog multi-threading support.

Current research concentrates on high-level multi-threading features. The results obtained show that Prolog core multi-threading support is enough to implement independent and-parallelism and competitive or-parallelism. These two forms of parallelism are fully implemented in the current Logtalk version. Despite all past work on parallel logic programming systems, Logtalk is today one of the few systems that can be downloaded and used right out of the box to take advantage of multi-core architectures. A comprehensible set of multi-threading benchmarks was developed to test compatible back-end compilers (SWI-Prolog, XSB, and YAP). The next step is to use Logtalk multi-threading features in field problems. Interesting application areas are characterized by computational complex problems where several heuristic approaches are available. Two closely related research interests include exploring the role of tabling on competitive or-parallelism and exploring the Logtalk high-level multi-threading features in parallel, distributed environments using grids with multi-core nodes.

4.3 Research Groups

April 2008 — Now

Center for Research in Advanced Computing Systems (CRACS), INESC, Porto.

January 1990 — August 1999

Center for Informatics and Systems, University of Coimbra

4.4 Publications

4.4.1 International Peer-reviewed Conferences

Programming Patterns for Logtalk Parametric Objects, Paulo Moura, LNAI, Springer-Verlag Berlin Heidelberg. 2010 (to appear). This is an extended version of the INAP 2009 paper.

ESProNa: Constraint-Based Declarative Business Process Modeling, Michael Iglar, Paulo Moura, Michael Zeising, and Stefan Jablonski, Third International Workshop on Dynamic and Declarative Business Processes (DDBP), October 2010 (to appear).

Towards a Study of Meta-Predicate Semantics, Paulo Moura, Proceedings of the 10th Colloquium on Implementation of Constraint Logic Programming Systems (CICLOPS), July 2010.

Knowledge Representation Using Logtalk Parametric Objects, Paulo Moura, Proceedings of the 18th International Conference on Applications of Declarative Programming and Knowledge Management (INAP), University of Évora, Portugal, November 2009, pp 225–240.

Secure Implementation of Meta-predicates, Paulo Moura, Proceedings of the 11th International Symposium on Practical Aspects of Declarative Languages (PADL), Savannah, GA, USA, January 2009, LNCS 5418, pp. 269–283, Springer-Verlag Berlin Heidelberg (a preview of this work was presented at the 8th Colloquium on Implementation of Constraint Logic Programming Systems (CICLOPS), December 2008, with the same title).

High Level Thread-Based Competitive Or-Parallelism in Logtalk, Paulo Moura, Ricardo Rocha and Sara C. Madeira, Proceedings of the 11th International Symposium on Practical Aspects of Declarative Languages (PADL), Savannah, GA, USA, January 2009, LNCS 5418, pp. 107–121, Springer-Verlag Berlin Heidelberg. This is a follow up paper to the ICLP 2008 *Thread-Based Competitive Or-Parallelism* short paper.

Thread-Based Competitive Or-Parallelism, Paulo Moura, Ricardo Rocha and Sara C. Madeira, Proceedings of the 24th International Conference on Logic Programming (ICLP), Udine, Italy, December 2008, LNCS 5366, pp. 713–717, Springer-Verlag Berlin Heidelberg.

High-Level Multi-threading programming in Logtalk, Paulo Moura, Paul Crocker and Paulo Nunes, Proceedings of the 10th International Symposium on Practical Aspects of Declarative Languages (PADL), San Francisco, CA, USA, January 2008, LNCS 4902, pp. 265–281, Springer-Verlag Berlin Heidelberg (a preliminary version of this work was presented at the 7th Colloquium on Implementation of Constraint LOGic Programming Systems (CICLOPS), September 2007, with the title *Multi-threading programming in Logtalk*).

Logtalk Processing of STEP Part 21 Files, Paulo Moura and Vincent Marchetti, Proceedings of the 22nd International Conference on Logic Programming (ICLP), Seattle, WA, USA, August 2006, LNCS 4079, pp. 453–454, Springer-Verlag Berlin Heidelberg.

4.4.2 National Peer-reviewed Conferences

Logtalk: Programação Orientada para Objectos em Prolog (Logtalk: Object-Oriented Programming in Prolog), Paulo Moura and Ernesto Costa, 2^a Conferência e Exposição Portuguesa de Tecnologia Orientada por Objectos, 1994, 3i Consultores, Lisboa.

4.4.3 Unpublished Papers

Category-Based Composition in Object-Oriented Languages, Paulo Moura, April 2000 (available at http://logtalk.org/papers/categories_oopsla.pdf; 11 pages). (also available at http://logtalk.org/papers/categories_ecoop.pdf; 31 pages).

4.4.4 Technical Reports

Logtalk 2.6 Documentation, Paulo Moura, Technical Report DMI–2000/1 University of Beira Interior, July 2000 (available at <http://logtalk.org/papers/trdmi20001a4.pdf>; 128 pages).

4.4.5 Manuals

Logtalk 2.38.0 User Manual, Paulo Moura, December 2009 (available at <http://logtalk.org/papers/lgtuserman2380.pdf>; 123 pages).

Logtalk 2.38.0 Reference Manual, Paulo Moura, December 2009
(available at <http://logtalk.org/papers/lgtrefman2380.pdf>; 144 pages).

4.4.6 Opinion Articles

Uniting the Prolog Community: Personal Notes, Paulo Moura, Association for Logic Programming (ALP) Newsletter, Vol. 22/1, February/March 2009.

Prolog Portability and Standardization, Paulo Moura, Association for Logic Programming (ALP) Newsletter, Vol. 18/3, August 2005.

Logtalk 2.18.0, Paulo Moura, Association for Logic Programming (ALP) Newsletter, Vol. 17/3, August 2004.

Some notes on porting a Prolog program to 22 Prolog compilers or the relevance of the ISO Prolog standard, Paulo Moura, Association for Logic Programming (ALP) Newsletter, Vol. 12/2, May 1999.

4.5 Invited Talks

From Plain Prolog to Logtalk Objects: Effective Code Encapsulation and Reuse. 25th International Conference on Logic Programming (ICLP), July 2009. LNCS 5649, p. 23, Springer-Verlag Berlin Heidelberg.

Multi-threading Programming in Logtalk. New University of Lisbon, Department of Computer Science. May 2007.

Video Compression and Streaming. Polytechnic Institute of Guarda. March 2005.

Code reuse in Object-Oriented Programming — Inheritance, Composition and Components. University of Beira Interior. March 2004.

Video Streaming. University of Beira Interior. March 2003.

XML Basics. University of Beira Interior. September 2002.

Logtalk: Object-Oriented Programming in Prolog. 4th National Logic Programming Contest. University of Beira Interior. April 2001.

Logtalk: Object-Oriented Programming in Prolog. University of Minho, Department of Informatics. October 1999.

Logtalk: Object-Oriented Programming in Prolog. University of Porto, Department of Computer Science. June 1999.

Logtalk: Object-Oriented Programming in Prolog. University of Coimbra, Computer Engineering Department. May 1999.

Logtalk: Object-Oriented Programming in Prolog. New University of Lisbon, Department of Computer Science. December 1998.

4.6 Scientific Panel Participation

Future Logic Programming Languages. XXI International Conference on Logic Programming (ICLP), October 2005.

4.7 Research Collaboration in Grant-funded Projects

FCT research project PTDC/EIA/67738/2006 *STAMPA — Sophisticated TAbling Mechanisms for Prolog and their Applications.*

FCT research project PTDC/EIA/70830/2006 *MOGGY — A Browser-Based Massive Multiplayer Online Game Engine Architecture.*

FCT research project POSC/EIA/63046/2004 *STEINER — A Geometric Engine for Inhomogeneous Implicit Surfaces with Singularities.*

FCT research project Sapiens 99 OM/36216/99-00 *Akademia — Information Technology and New Types of On-line Journalism*, University of Beira Interior (developed multimedia publishing systems).

Research project PRAXIS 2/2.1/DC&T/1939/96 — *Multimedia Website for the Physics Museum of the University of Coimbra* (developed the museum virtual reality tour using Apple's QuickTimeVR technology; available at <http://museu.fis.uc.pt/>).

4.8 Thesis Committees

4.8.1 PhD Theses

Rui Filipe Pereira Marques. *Concurrent Tabling: Algorithms and Implementation*. Department of Computer Science. New University of Lisbon. November 2007.

4.8.2 MSc Theses

Pedro Raul Borges Costa Teodoro. *Type Inference in Ruby*. Department of Computer Science. New University of Lisbon. December 2008.

Nuno Eduardo Quaresma Morgadinho. *Distributed Multi-Threading in GNU Prolog*. Department of Computer Science. University of Évora. October 2007.

Pedro Miguel Pereira Mota da Costa. *Relational Storage Mechanisms for Tabled Logic Programs*. Department of Computer Science. University of Porto. July 2007.

4.9 Academic Supervision

4.9.1 PhD Theses

Michael Iglér. *A Semantics Engine for Process Execution* (provisional title). University of Bayreuth, Germany. Status: in progress.

Paulo Jorge da Costa Nunes. *Multi-Threaded Lock-Free Tabling for Logic Programming* (provisional title).

University of Beira Interior, Portugal. Status: in progress.

4.9.2 MSc Theses

Leila Barros. *Estudo e implementação de uma solução de gestão de documentos no contexto da empresa de fornecimento de água e electricidade Electra de Cabo Verde* (Study and implementation of document management system for water and electricity supply for the Electra company of Cabo Verde).

University of Beira Interior, Portugal. Status: in progress.

Zenaida Gomes, *Desenvolvimento de um sistema de informação para comunicação e gestão de leituras de consumos de água e electricidade no contexto da empresa Electra de Cabo Verde* (Study and implementation of an information system for water and electricity consumption for the Electra company of Cabo Verde).

University of Beira Interior, Portugal. Status: in progress.

4.10 Prolog Standardization Committees

Chair of the Portuguese Technical Committee for the standardization of the Prolog programming language (IPQ CT 167 - “Programming Languages – Prolog”), which represents Portugal in the ISO SC22 WG17 (Prolog) workgroup:

<http://www.inst-informatica.pt/servicos/normalizacao/comissoes-tecnicas/>
<http://www.sju.edu/~jhodgson/wg17/wg17web.html>

Editor of the following ISO Prolog standardization proposals:

- Definite clause grammar rules (ISO/IEC DTR 13211—3:2006).
- Prolog Multi-threading support (ISO/IEC DTR 13211—5:2007).
- New built-in flags, predicates, and functions proposal (ISO/IEC DTR 13211—1:2006).
- Portable Operating-system Interface proposal.

Moderator of the ISO Prolog standardization discussion forums available at:

<http://prolog.logtalk.org/>

PDF version of the standardization proposals are available from this web site.

4.11 Conference Program Committees

Colloquium on Implementation of Constraint LOGic Programming Systems (CICLOPS 2010).

International Conference on Logic Programming (ICLP 2009)

Colloquium on Implementation of Constraint LOGic Programming Systems (CICLOPS 2009).

Compilers, Related Technologies and Applications (CoRTA 2007).

Colloquium on Implementation of Constraint LOGic Programming Systems (CICLOPS 2007).

4.12 Journal Refereeing

Theory and Practice of Logic Programming (TPLP)

4.13 Conference Refereeing

Practical Aspects of Declarative Languages (PADL 2010).

International Conference on Logic Programming (ICLP 2009)

Colloquium on Implementation of Constraint LOGic Programming Systems (CICLOPS 2009).

Practical Aspects of Declarative Languages (PADL 2009).

Compilers, Related Technologies and Applications (CoRTA 2008).

Compilers, Related Technologies and Applications (CoRTA 2007).

Colloquium on Implementation of Constraint LOGic Programming Systems (CICLOPS 2007).

4.14 Conference and Workshop Organization

Co-organizer of the 9th International Colloquium on Implementation of Constraint Logic Programming Systems (CICLOPS 2009).

Co-organizer of the Fourth International Workshop on (Constraint) Logic Programming and Software Engineering (CLPSE 2009). This workshop was cancelled due to insufficient submissions.

4.15 Professional and Academic Society Membership

Associação Portuguesa para a Inteligência Artificial.

Association for Logic Programming.

Association for Computing Machinery.

5 Software Development

All software under development aims to support and make available research results in Programming Languages. All software is freely available under open source licenses.

5.1 Logtalk

Logtalk is an object-oriented logic programming language that can use most Prolog implementations as a back-end compiler. As a multi-paradigm language, it includes support for both prototypes and classes, protocols (interfaces), component-based programming through category-based composition, event-driven programming, and multi-threading programming. The Logtalk web site is:

`http://logtalk.org/`

Logtalk is the *de facto* standard for Object-Oriented Programming in Prolog. The language is used both in research work and in the development of commercial applications.

The current distribution includes 70 programming examples, used by the developer and by third parties in undergraduate and postgraduate classes. Development of Logtalk 2.x started in January 1998. Since then, 37 major versions and 85 minor updates were released. The number of Logtalk downloads per month ranges from 1500 to 2100, depending on the release schedule of new versions. Current Logtalk development is guided by the developer research and by the feedback of the user community.

5.2 STEP Files (CAD/CAM) Validation Tools

Joint work with Vincent Marchetti (KShell Analysis) and Paul Crocker (University of Beira Interior) in the development of STEP files (CAD/CAM) validation tools, implemented in Logtalk:

<http://www.kshell.com/logtalk/>

A description of this work was presented at the 22nd International Conference on Logic Programming (2006). Current work includes parallelization of the validation tasks, implementation of ISO STEP application protocols, and improving Logtalk scalability for compiling source files with tens of thousands of object definitions. The software is distributed under the GNU GPL v2 license. It can be downloaded from:

<http://code.google.com/p/lgtstep/>

5.3 L-FLAT — Logtalk toolkit for Formal Languages and Automata Theory

Joint work with Artur Miguel Dias (New University of Lisbon) in the development of L-FLAT, a Logtalk version of the P-FLAT (*Prolog toolkit for Formal Languages and Automata Theory*) educational software. Our goal is to implement a modular architecture and to improve Prolog compatibility. The current version of L-FLAT can be downloaded from:

<http://code.google.com/p/lgtpflat/>

5.4 Logtalk and Prolog Programming Support

Development of support for Logtalk and ISO Prolog programming (e.g. syntax coloring, code folding, code completion, auto-indentation, templates and macros) for several text editors including *Emacs*, *Vim*, *TextMate*, *SubEthaEdit*, *Nedit*, *Kate* (and *Kwrite*), *E*, *jEdit*, and editors based on *GtkSourceView 2* (e.g. *Gedit*).

Development of support for syntax highlighting of Logtalk and ISO Prolog source files for the following highlighters: *Pygments*, *Source-highlight*, and *Highlight*.

(All supporting files are included in the current Logtalk distribution; in most cases, the supporting files are also included in the text editor and syntax highlighter distributions.)

5.5 Prolog Development

Regular contributor to the development of several Prolog compilers, particularly YAP, XSB, and SWI-Prolog. Contributions include porting work, writing installers, implementing missing functionality, fixing and updating documentation, working on ISO Prolog compliance, and diagnosing, reporting, and sometimes fixing, of dozens of compiler bugs in B-Prolog, Amzi! Prolog, CxProlog, ECLiPSe, GNU Prolog, JIProlog, K-Prolog, Qu-Prolog, SICStus Prolog, SWI-Prolog, XSB, and YAP (consequence of standardization work and Logtalk portability work).

Maintenance of the MacPorts (<http://www.macports.org/>) *portfiles* for GNU Prolog, SWI-Prolog, and YAP (these portfiles allow the creation of binary installers, subsuming porting work of these Prolog compilers to the MacOS X operating-system).

6 Conference Attendance

XXV International Conference on Logic Programming (ICLP), 2009

19th Workshop on Logic-based methods in Programming Environments (WLPE), 2009

9th Colloquium on Implementation of Constraint LOGic Programming Systems (CICLOPS), 2009

International Symposium on Practical Aspects of Declarative Languages (PADL), 2009

XXIV International Conference on Logic Programming (ICLP), 2008

8th Colloquium on Implementation of Constraint LOGic Programming Systems (CICLOPS), 2008

International Symposium on Practical Aspects of Declarative Languages (PADL), 2008

7th Colloquium on Implementation of Constraint LOGic Programming Systems (CICLOPS), 2007

Compilers, Related Technologies and Applications (CoRTA), 2007.

XXII International Conference on Logic Programming (ICLP), 2006

XXI International Conference on Logic Programming (ICLP), 2005

8^o Encontro Português para a Inteligência Artificial (EPIA), 1997

2^a Conferência e Exposição Portuguesa de Tecnologia Orientada por Objectos, 1994

4^o Encontro Português para a Inteligência Artificial (EPIA), 1989